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The SVO Filter Profile Service

Astronomical filter standardization in the VO context

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During the last years, and with the advent of several important photometric surveys, many astronomical studies are taking an increasingly multi-wavelength approach. But to combine photometric data coming from different sources it is necessary that these measurements are described and characterized in sufficient detail to allow for the conversion to compatible flux density and spectral energy units.

In the Spanish Virtual Observatory we maintain the "Filter Profile Service" (<http://svo2.cab.inta-csic.es/theory/fps/>), that provides standardized information, including transmission curves and calibration, about more than 6100 astronomical filters. The service is designed to be compliant to the Virtual Observatory Photometry Data Model and all the information is provided both as a web portal and VO services so that other services and applications can access the relevant properties of a filter in a simple way.

Introduction



Nowadays, multi-wavelength astronomical studies are more and more common.

- To combine photometric data coming from different sources it is necessary that these measurements are described and characterized in sufficient detail to allow for the conversion to compatible flux density and spectral energy units.
- This includes a proper characterization of the particular instruments and filters used to get the observed data.
- If these observed data are to be compared with theoretical models, we even need the filter transmission data, to calculate synthetic photometry.

Taking all this into account SVO developed in 2008 a Filter Profile Service (FPS), compiling as much information as possible for astronomical filters.

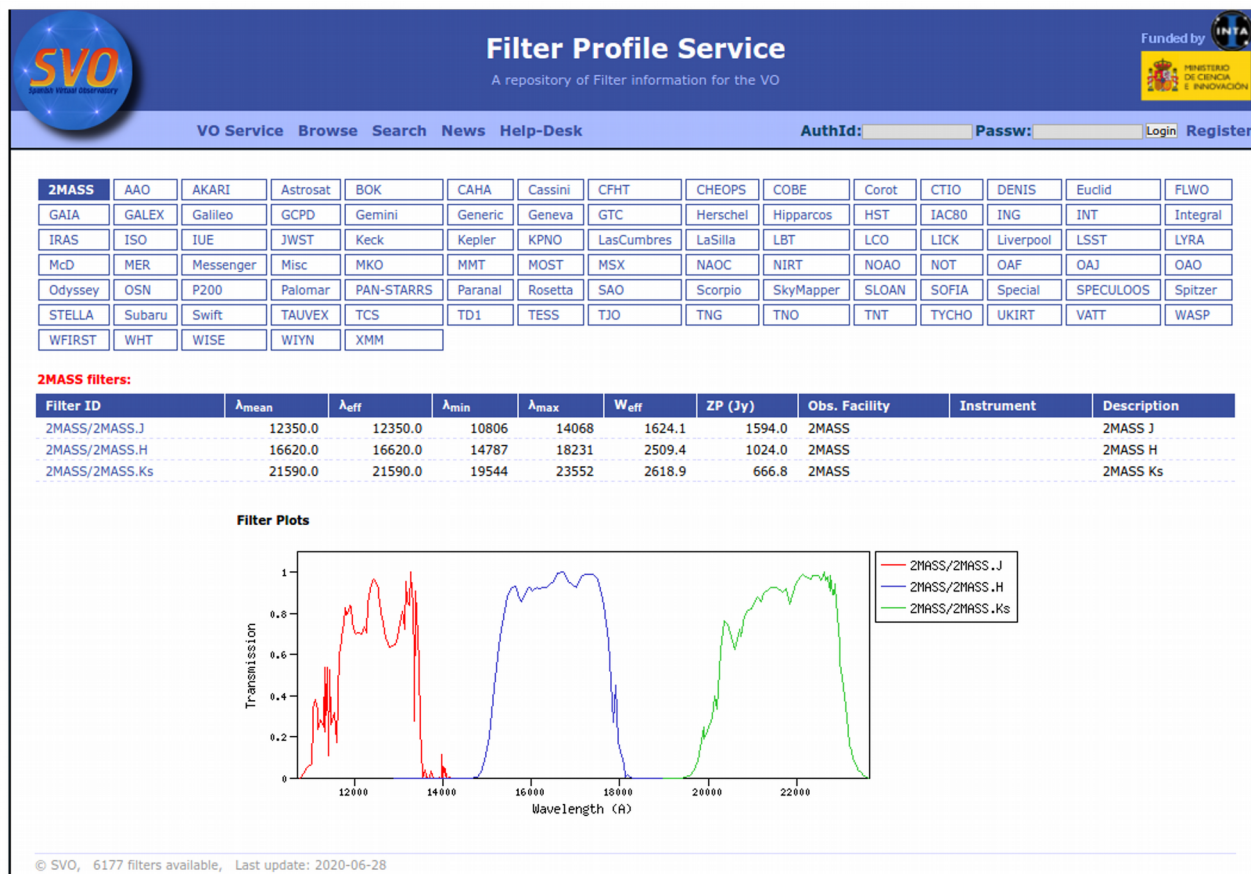
Main use cases:

- Transform catalog magnitudes into fluxes,
- Calculate synthetic photometry for theoretical models or for observed spectra,
- Compare observed and synthetic photometry.
- Flux calibration of instrumentally-corrected spectra using catalogue magnitudes.

Web access



<http://svo2.cab.inta-csic.es/theory/fps/>

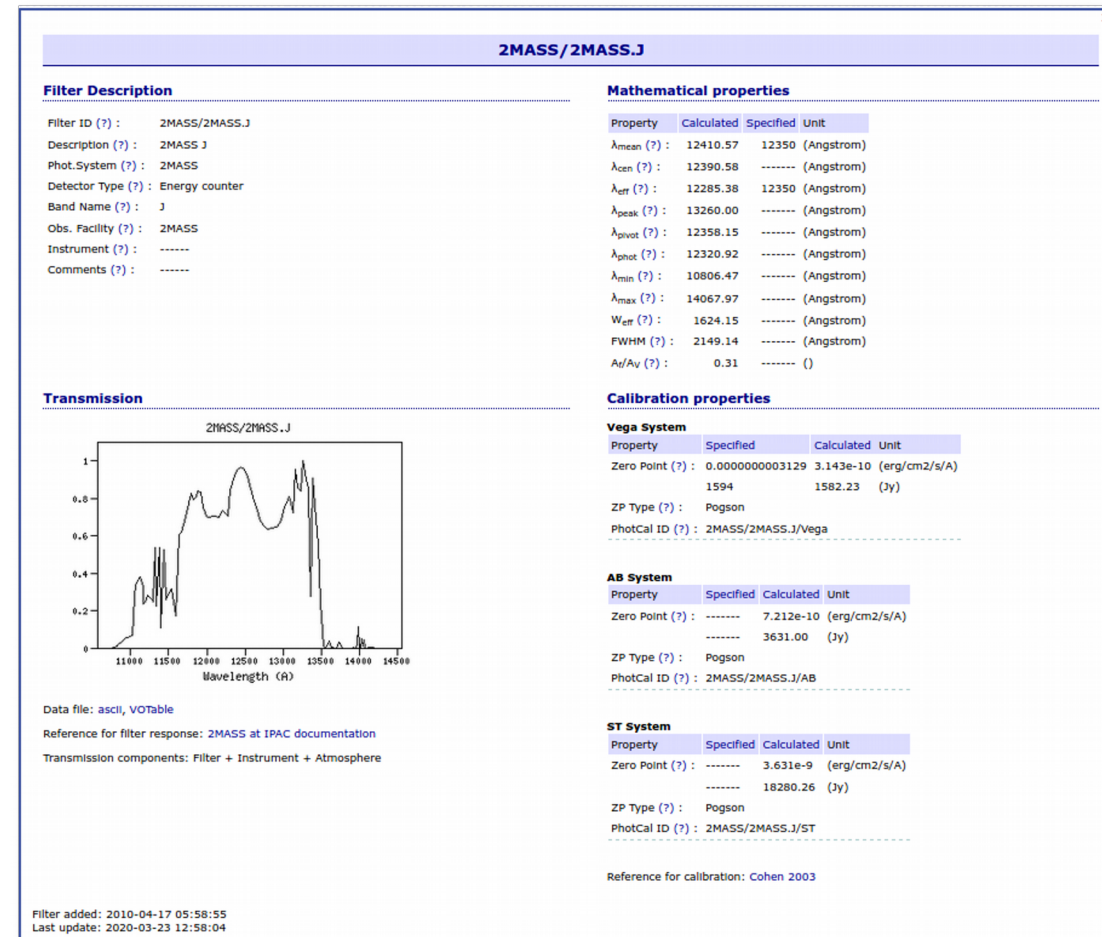


More than 6100 different filters.

~ 100 different facilities.

~ 200 different instruments.

- Transmission curves,
- Mathematical properties,
- Reference wavelengths,
- Zero points, etc.



VO access



<http://svo2.cab.inta-csic.es/theory/fps/fps.php?ID=2MASS/2MASS.H>

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

- 1: 2MASS.H

Current Table Properties

Label: 2MASS.H

Location: <http://svo2.cab.inta-csic.es/theory/fps/fps.php?ID=2MASS/2MASS.H>

Name: 2MASS.H

Rows: 58

Columns: 2

Sort Order:

Row Subset: All

Activation Actions: 0 / 1

266 / 3554 M

TOPCAT(1): Table Parameters

Window Parameters Display Help

Table Parameters for 1: 2MASS.H

Δ Name	Value	Units	Description	UCD	Utype
Band	H				photdm:PhotometryFilter.band
CalibrationReference	http://adsabs.harvard.edu/abs/2003A...				
Column Count	2		Number of columns		
Description	2MASS H			meta.note	photdm:PhotometryFilter.descr
Description	2MASS H			meta.note	photdm:PhotometryFilter.descr
FWHM	2609.6475	Angstrom	Full width at half maximum. Defined a...	instr.bandwidth	
Facility	2MASS		Observational facility	instr.obsty	
FilterProfileService	ivo://svo/fps			meta.ref.ivorn	PhotometryFilter.fpsIdentifier
MagSys	Vega			meta.code	photdm:PhotCal.MagnitudeSystem.type
Name	2MASS.H		Table name		
PhotCallID	2MASS/2MASS.H/Vega			meta.id	photdm:PhotCal.identifier
PhotSystem	2MASS		Photometric system		photdm:PhotometricSystem.description
ProfileReference	http://www.ipac.caltech.edu/2mass/re...				
QUERY_STATUS	OK				
Row Count	58		Number of rows		
WavelengthCen	16487.193	Angstrom	Central wavelength. Defined as the c...	em.wl	
WavelengthEff	16620.0	Angstrom	Manually specified. See reference	em.wl.effective	
WavelengthMax	18231.02	Angstrom	Maximum filter wavelength. Defined a...	em.wl;stat.max	photdm:PhotometryFilter.SpectralAxis.c
WavelengthMean	16620.0	Angstrom	Manually specified. See reference	em.wl	photdm:PhotometryFilter.SpectralAxis.c
WavelengthMin	14787.379	Angstrom	Minimum filter wavelength. Defined a...	em.wl;stat.min	photdm:PhotometryFilter.SpectralAxis.c
WavelengthPeak	16710.0	Angstrom	Peak wavelength. Defined as the lam...	em.wl	
WavelengthPhot	16423.764	Angstrom	Photon distribution based effective w...	em.wl	
WavelengthPivot	16457.506	Angstrom	Peak wavelength. Defined as sqrt{int...	em.wl	
WavelengthUCD	em.wl			meta.ucd	PhotometryFilter.SpectralAxis.UCD
WavelengthUnit	Angstrom			meta.unit	PhotometryFilter.SpectralAxis.unit
WidthEff	2509.4023	Angstrom	Effective width. Defined as integ[x*fil...	instr.bandwidth	photdm:PhotometryFilter.SpectralAxis.c
ZeroPoint	1024.0	Jy		phot.flux.density	photdm:PhotCal.ZeroPoint.Flux.value
ZeroPointType	Poisson			meta.code	photdm:PhotCal.ZeroPoint.type

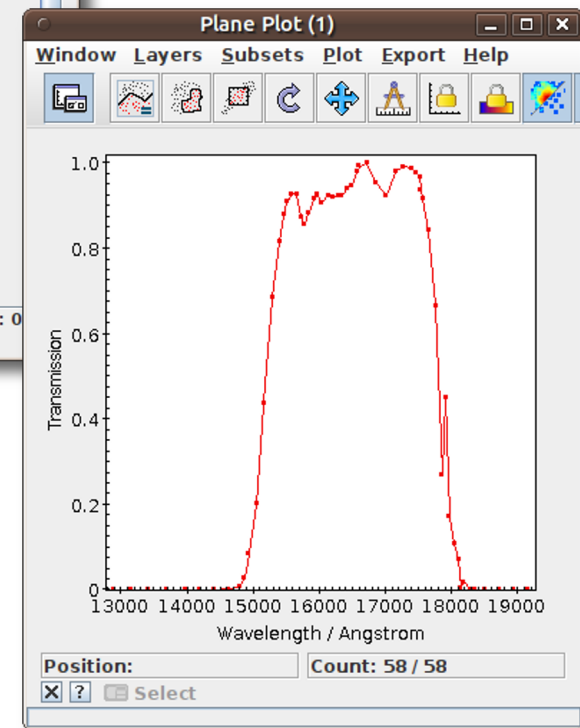
TOPCAT(1): Table Browser

Window Rows Help

Table Browser for 1: 2MASS.H

	Wavelength	Transmission
6	14180.	0.
7	14400.	0.0005
8	14620.	0.0028
9	14780.	0.0081
10	14860.	0.0287
11	14930.	0.0871
12	15040.	0.2014
13	15150.	0.4382
14	15280.	0.6864
15	15390.	0.8181
16	15460.	0.8821
17	15510.	0.9118
18	15560.	0.9269
19	15650.	0.9293
20	15720.	0.8727
21	15770.	0.8566
22	15830.	0.8826
23	15920.	0.9181
24	15970.	0.9267
25	16020.	0.9076
26	16120.	0.8966

Total: 58 Visible: 58 Selected: 0

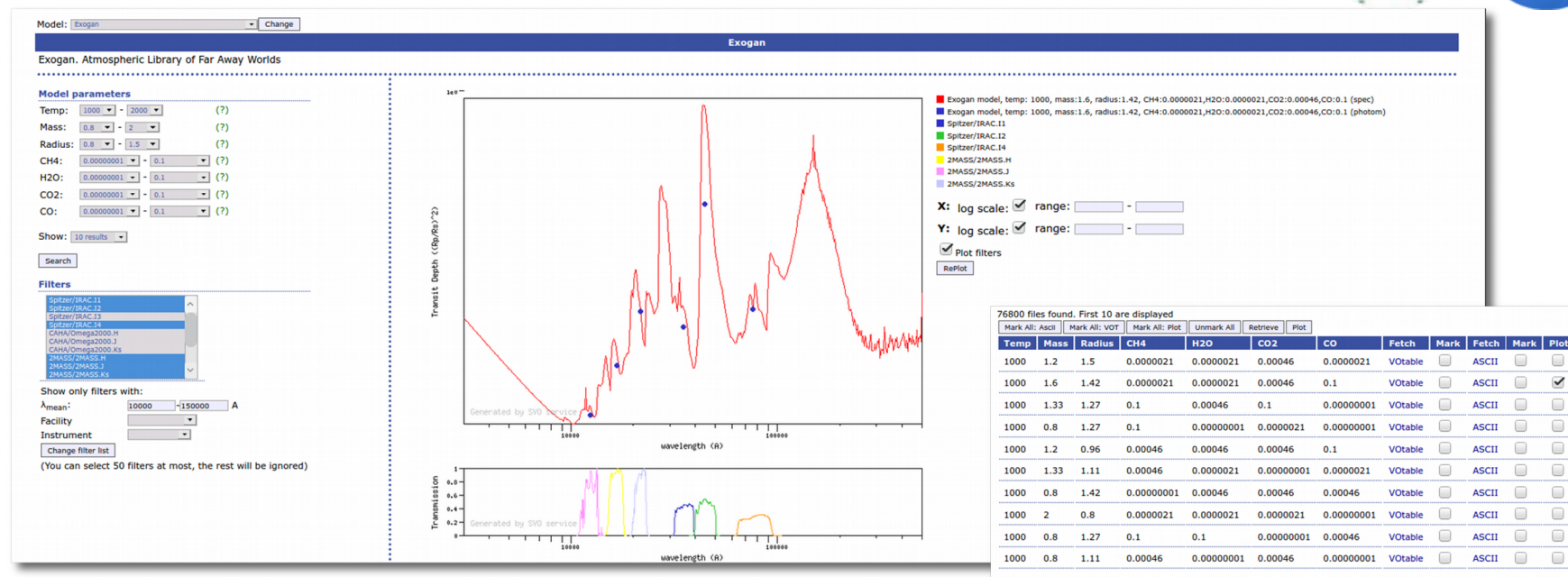


SVO applications making use of FPS



- Synthetic photometry for the 64 collections of theoretical spectra or observational templates (~265.000 spectra) in the ~6100 filters.

<http://svo2.cab.inta-csic.es/theory/newov2/syph.php>

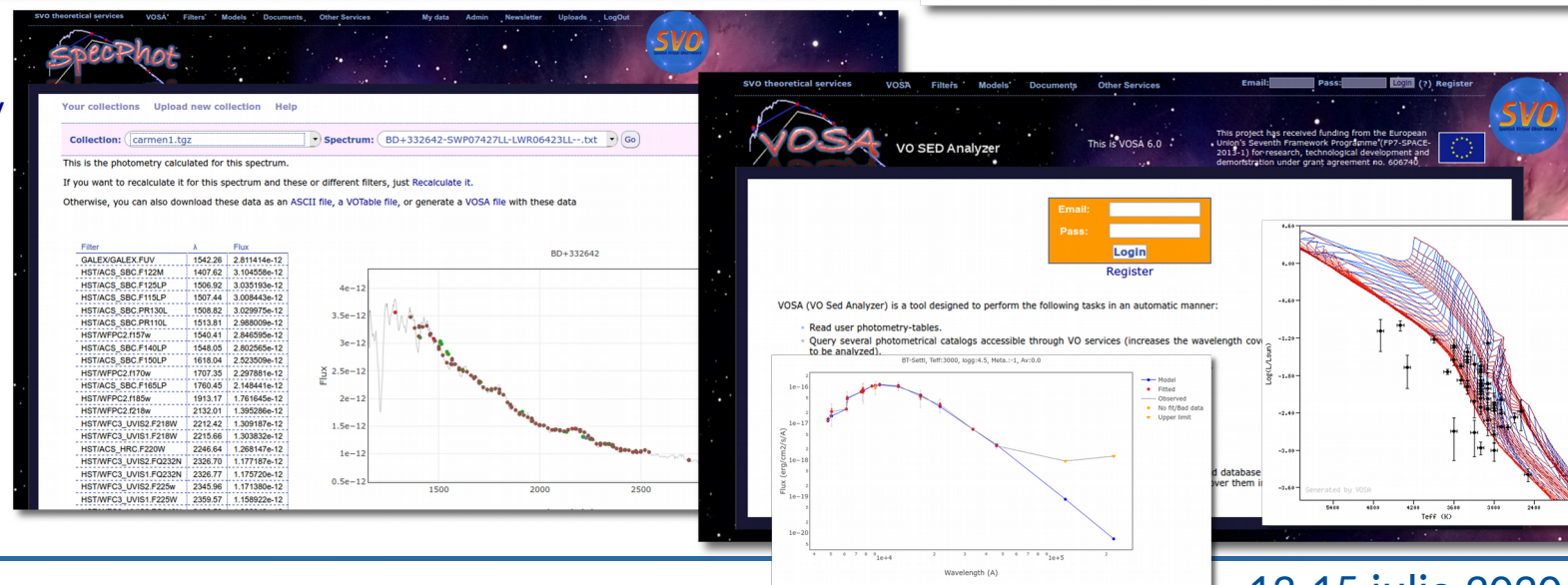


- Specphot
Calculate photometry for your own spectra.

<http://svo2.cab.inta-csic.es/theory/specphot/>

- VOSA (VO SED analyzer)
SED fitting for thousands of objects at a time.

<http://svo2.cab.inta-csic.es/theory/vosa/>

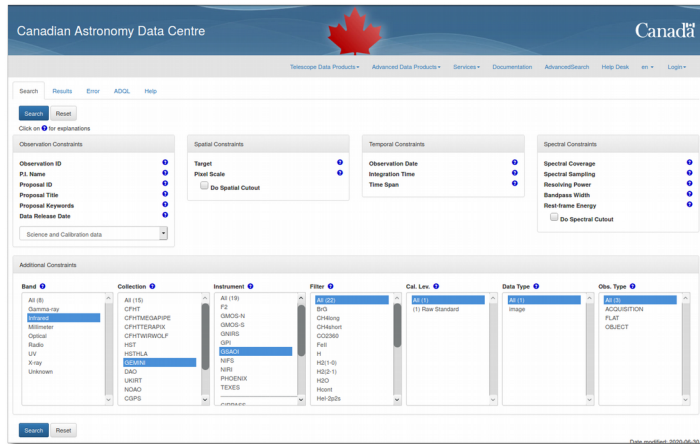


Other (no-SVO) services making use of FPS



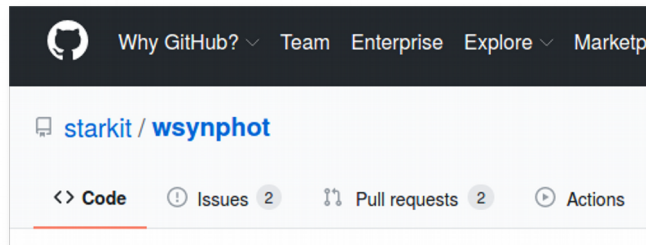
Canadian Astronomy Data Center Advanced Search Interface

- Enhance metadata of their database images.
- <https://www.cadc-ccda.hia-ihc.nrc-cnrc.gc.ca/en/search/>



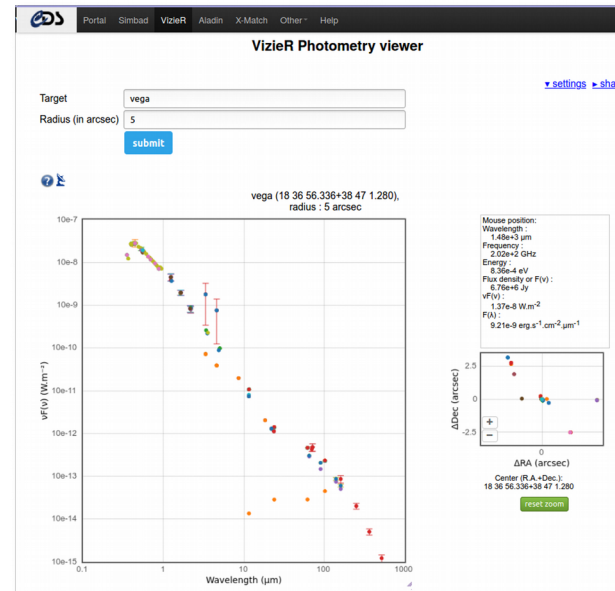
Starkit/Wsynphot

- Python project for synthetic photometry
- <https://github.com/starkit/wsynphot/>



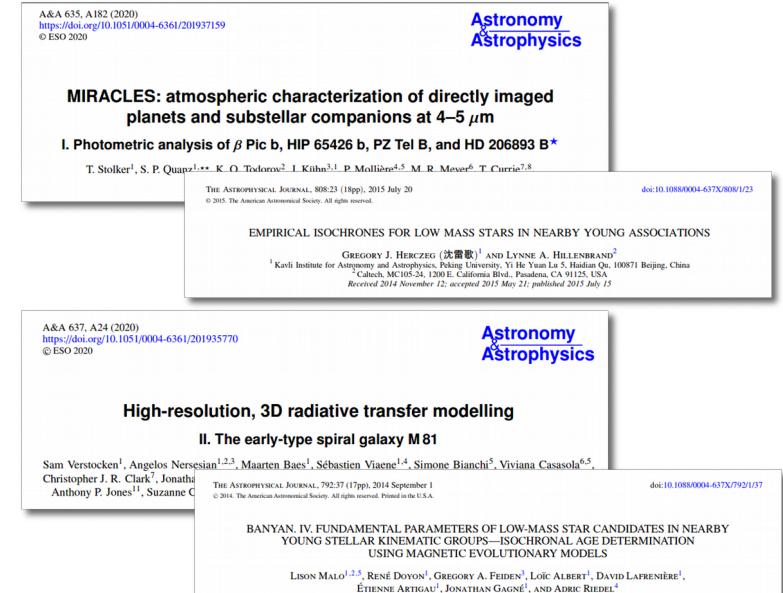
VizieR photometry viewer

- Using filter properties from the FPS.
- <http://vizier.unistra.fr/vizier/sed/>



81 refereed papers using the SVO FPS.

- 15 papers in 2020



The near and mid-infrared photometric properties of known redshift $z \geq 5$ quasars

Nicholas P Ross, Nicholas J G Cross

Monthly Notices of the Royal Astronomical Society, Volume 494, Issue 1, May 2020, Pages 789–803, <https://doi.org/10.1093/mnras/staa544>

Published: 13 March 2020 Article history



PSR J1012+5307: a millisecond pulsar with an extremely low-mass white dwarf companion

D Mata Sánchez, A G Istrate, M H van Kerkwijk, R P Breton, D L Kaplan

Monthly Notices of the Royal Astronomical Society, Volume 494, Issue 3, May 2020, Pages 4031–4042, <https://doi.org/10.1093/mnras/staa983>

Published: 13 April 2020 Article history

Some numbers and additional info



More than 6100 different filters.

- ~ 100 different facilities.
- ~ 200 different instruments.

Usage:

- ~ 5.5 million requests last year
(~ 15.000 per day)
- ~ 80 refereed papers using the service.

Web and VO services

- <http://svo2.cab.inta-csic.es/theory/fps/>

According to IVOA Photometry data model.

- <http://www.ivoa.net/documents/PHOTDM/>

More info:

- <http://ivoa.net/documents/Notes/SVOFPS/>
- <http://ivoa.net/documents/Notes/SVOFPSDAL/>